British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

South Georgia Magnetic Observatory

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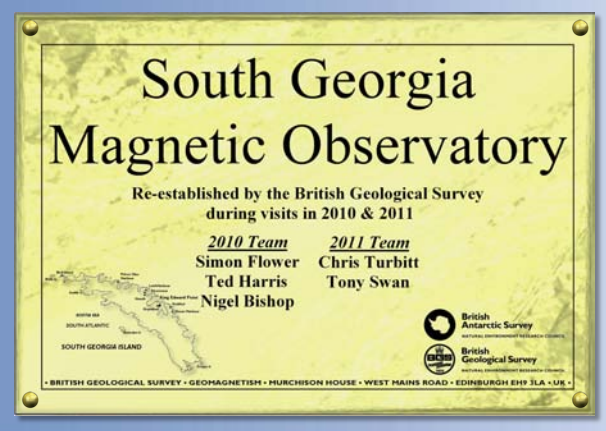
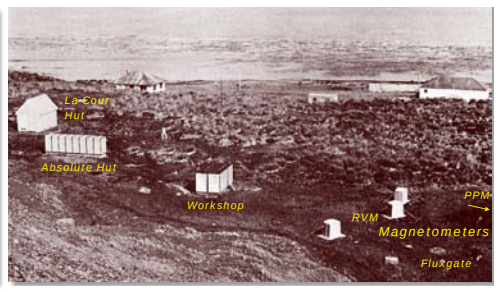


South Georgia lies in the South Atlantic Ocean at 37°W, 54.5°S, about 1300 Km SE of the Falkland Islands. At 170 Km long it is the largest of a group known as South Georgia & the South Sandwich Islands (SGSSI). There is no native population on the islands, the inhabitants being SGSSI Government Officers and fishery scientists and support staff from the British Antarctic Survey who maintain scientific bases at Bird Island and King Edward Point.

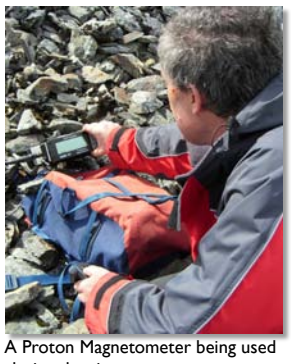
One of the main functions of a establishing a new observatory on South Georgia is to provide data for global models of the Earth's magnetic field. The improved spatial distribution of geomagnetic observatories is a goal to improve the quality of these models and mid-ocean islands are therefore important observing locations to help achieve this. South Georgia is also particularly interesting because it sits near a rapidly weakening feature in the Earth's field, known as the South Atlantic Anomaly. The new observatory installation was planned over two phases. Phase one in early 2010, saw the installation of the observatory infrastructure, instrument pier and building foundations and the fluxgate and proton magnetometer housings. Phase two, in early 2011 saw the completion of the Absolute House and the installation of all cabling, instruments and communications. The observatory was commissioned in late February 2011 when the first data were received in Edinburgh.

New Beginnings - Phase 1 February 2010

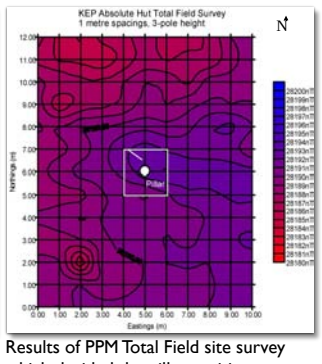
Prior to the Falklands conflict, the British Antarctic Survey (BAS) operated a magnetic observatory at King Edward Point from 1975 to 1982. During the occupation of South Georgia, the observatory site suffered heavy damage and was subsequently abandoned. In 2008, the British Geological Survey (BGS) took the decision to re-establish a magnetic observatory on South Georgia in collaboration with BAS. In January 2010, after months of planning and shipping of observatory components & hardware, two BGS staff members arrived on South Georgia to spend the next two weeks laying the foundations and infrastructure for the new observatory.



Above left: The only known colour photograph which shows the Magnetic Observatory operated at King Edward Point prior to 1982. The photograph was taken in the mid 1970s and shows the three yellow huts in the background which housed the NE, NW and Z component Rubidium Vapour Magnetometers. The three buildings to their right are the workshop, the Absolute House and the La Cour House, with the pitched roof. A Fluxgate and Proton Magnetometer were also deployed, but are not visible in the photograph.



A Proton Magnetometer being used during the site survey.



Results of PPM Total Field site survey which decided the pillar position.

Installing ducting & earthing/lightning protection mats. The old Absolute Hut foundations are clearly visible.

Metal plates laid by the military to bridge soft ground, which were uncovered during surveying.

Construction work in South Georgia's variable mid-summer weather.

The site in Feb. 2010 from the Absolute Observing Position showing (L to R) the Fluxgate & Proton housings and the intermediate cable junction box.

Proton (foreground) and Fluxgate enclosures.

Sun Observations being made.

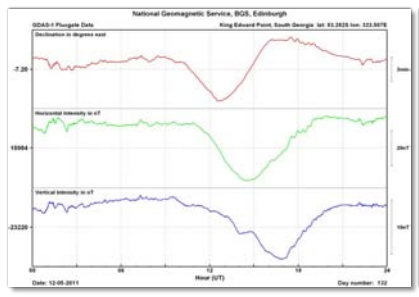
Completion & Results - Phase 2 February 2011

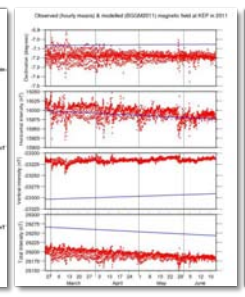
Following the initial installation visit in 2010, two BGS staff again made the 9000 mile trip to South Georgia in February 2011 to complete the installation and complete the observatory. In the interviening period, all the instrumentation, communication hardware and the specially commissioned sectional 'flat pack' Absolute House, had been shipped to South Georgia. On arrival, and with the advantage of calm weather, the team made good progress and the installation was completed ahead of schedule. This left ample time for BAS staff, who would run the observatory, to be familarised with the systems and also be trained in performing Absolute Observations.

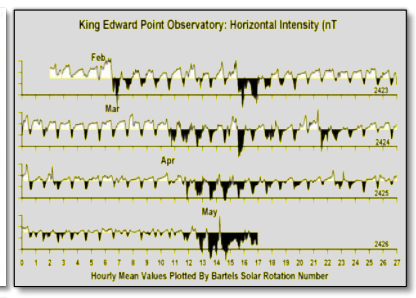
(L to R) The new Absolute House, showing its proximity to the main buildings. The completed observatory with Grytviken & Mt. Hodges in the background

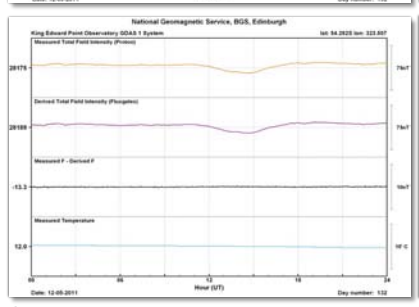
Power and communications cabling in Larsen House, King Edward Point.

The observatory, which has now been assigned the IAGA code KEP - King Edward Point became operational in February 2011. It operates under the control of the QNX based *Geomagnetic Data Acquisition System* (GDAS), which controls all data logging and communications. Measurements of horizontal (*H*) and vertical (*Z*) components & declination (*D*) are made using a *Danish Meteorological Institute* (DMI) tri-axial fluxgate magnetometer with a sampling interval of 1Hz. A proton precession magnetometer (PPM) measures (*F*) at a rate of 0.1Hz. The raw unfiltered, near real-time data are retrieved automatically via an internet connection to the BGS office in Edinburgh where the application of a 61-point cosine filter to the fluxgate data produces one-minute values of *H, D & Z*. The total field intensity samples are filtered using a 7-point cosine filter to produce one-minute values of *F*.

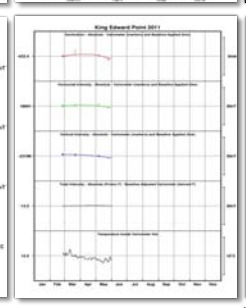




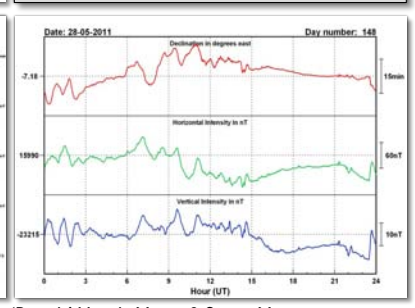




Quiet day daily variation & *F* comparison



Hourly Mean & Baseline plots



'Bartels' Hourly Means & Storm Magnetogram

Quality control is achieved by using total field comparisons from the scalar and vector instruments to assist in identifying any corrupt data, these can be removed the following day. Monthly quality control outputs are used to identify, as early as possible, any problems with the observatory systems.

The fluxgate magnetometer measures variations in the components of the field. In order to derive absolute magnitudes, a manual set of absolute observations are made by BAS staff once a month. A fluxgate theodolite is used to determine declination (*D*) and inclination (*I*) and the proton magnetometer (PPM), with a site difference correction applied, measures total field (*F*). The absolute observations are used in conjunction with the variometer measurements to produce a continuous record of the absolute values of the geomagnetic field elements as if they had been measured at the observatory reference pillar.

The prepared site in 2010: From the left are the new proton, intermediate and fluxgate enclosures (1,2 & 3). The Absolute House foundations and observing pier (4) are behind figure in red. Some of the pre 1982 installation foundations can also be seen. The old Absolute Hut foundations (5) were utilised in the construction of the intermediate housing. The workshop foundations (6) can be clearly seen as can the brick piers on which sat the Rubidium Vapour magnetometers (7,8 & 9). No trace was found of the La Cour Hut. This panorama was taken from near the same position as the monochrome picture to the right of the 1970s photo.

Published Monthly Bulletins of data from KEP and other BGS Magnetic Observatories are available at http://www.geomag.bgs.ac.uk/

Association: IAGA DIV.
Symposium: A131
Poster: 5773 (Mon 4th July)

IUGG Melbourne, Australia
28th June - 7th July 2011